REMARKS

Applicant wishes to thank the Examiner for the telephonic interview of December 8, 2004. Applicant's representatives Mark Kirkland and Alexander Fishkin, and Examiner Almis Jankus participated in the interview. Claims 1 and 11, and U.S. 6,369,816 (Knittel) were discussed. No agreement was reached.

Claims 1-20 are pending in this application. Claims 8 and 16-20 are allowed. Claims 1-6 and 9-15 were rejected under U.S.C. 102(e) as being anticipated by Knittel (US 6,369,816). Claim 7 was objected to on account of a typographical error. Applicant thanks the Examiner for indicating that claim 7 is merely objected to.

Claims 1 and 11-15 have been amended. In addition, claim 7 has been amended to account for a typographical error. No new matter has been added. Applicant respectfully traverses the rejections and requests reconsideration in view of the amendments and following remarks.

Claim 1

Claim 1, as amended, recites a method for approximating a gradient. The method includes receiving a gradient defining a nonlinear transition from one color or gray level to another in an image. The rate of transition is determined by a non-linear function. The method further includes identifying an error tolerance. The method includes approximating a portion of the gradient corresponding to the linear step with the linear step.

As explained in the reply to action of May 22, 2003, Knittel shows a method for determining the square root of a number, but does not teach or suggest approximating a gradient or portions thereof with a linear step(s). In response, the Examiner asserts that Knittel discloses at column11 lines 20-38 and at column 12, lines 37-43 approximating a curve using linear segments by connecting the points. The cited passages actually read as follows:

> "A preferred implementation is based on Newton-Raphson's method but varies significantly in that it is pipelined. The present implementation employs

only one iteration and **assumes <u>predefined</u> estimates of the square root at <u>predefined</u> points along the curve 1200 and tangents with <u>predefined</u> "slopes" connected, end-to-end, to approximate the square root function.** As a further requirement in order to minimize the number of gates, division and multiplication are not used, and all computations are merely shifts and adds.

The invention takes advantage of the fact the square root of a number expressed as a power-of-two (2^n) is $2^{n/2}$. So, a first approximation is made by a simple range determination. For a given input find a nearest power-of-two number, and use its square root as the first guess. Now, if the range check is done for odd powers-of-two (i.e., in 2^n, n is odd), the first approximation will be in the middle of a range reducing the largest possible error by half." [column 11, lines 20-38]

"However, the method can be improved to provide a better approximation without increasing the number of iterations, but rather by piecewise linear approximation of the square-root function that involves division by a fixed set of numbers that are not powers of two. The set of numbers is chosen so that division is can still be accomplished by a small number of shifts and adds in a fixed number of steps." [column 12, lines 37-43]

A careful review of the cited passages shows that Knittel teaches determining the square root of a number using "<u>predefined</u> estimates of the square root at <u>predefined</u> points along the [square root] curve 1200 and tangents with <u>predefined</u> 'slopes' connected, end-to-end, to approximate the square root function" [column 11, lines 24-27]. While Knittel discloses a method for determining the square root of a number using predefined estimates of the square root function, Knittel is silent with regard to "predetefining", or approximating, the square root function in accordance with the method described in claim 1. Knittel states that the predefined points along the square root curve can be numbers on the square root function that are powers of two (e.g., FIG. 12). Knittel also states that the predefined points along the square root can come from another *fixed* set of numbers [column 12, lines 37-41]. However, Knittel does not teach or suggest approximating a function (e.g., a function defining a gradient) by "identifying an error tolerance, selecting a starting point and a set point on a curve defined by the function, defining a linear step from the start point to the set point, calculating a maximum error between the linear step and the curve, if the maximum error is less than or equal to the error tolerance, approximating a portion of the gradient [function] corresponding to the linear step with the linear step, if the maximum error is more than the error tolerance, selecting a new set point on the curve

closer to the starting point and repeating the calculating step and error checking steps," as recited in claim 1. For at least this reason, claim 1 and its dependent claims are allowable.

Further as to claim 1, Knittel does not teach or suggest receiving a gradient defining a nonlinear transition from one color or gray level to another in an image, as described in claim 1. The Examiner states that Knittel discloses modulating lighting values using gradient magnitude vectors and complex functions in column 1, lines 17-18, and that modulating lighting values corresponds to color transitions. The Applicant respectfully disagrees. Knittel's gradient magnitude vectors are not the same as Applicant's gradients in that Knittel's gradients do not define a nonlinear transition from one color or gray level to another in an image. Instead, Knittel's gradients "indicate the direction and magnitude of surface normals," as stated in column 4, line 24-25 and shown in FIG. 10. For at least this reason, claim 1 and its dependent claims are allowable.

Claim 11

Claim 11, as amended, recites a method for approximating a gradient. The method includes receiving a gradient defining a nonlinear transition from one color or gray level to another in an image. The method further includes identifying an error tolerance and selecting an optimal number of set points on a curve defined by the function. The method further includes approximating the curve by a series of linear portions connecting the set points.

As explained in reference to claim 1, Knittel does not teach or suggest receiving a gradient defining a nonlinear transition from one color or gray level to another in an image. For at least this reason, claim 11 is allowable.

Further as to claim 11, while Knittel discloses a method for determining the square root of a number using predefined estimates of a square root function, Knittel is silent with regard to "predetefining", or approximating, the square root function in accordance with the method described in claim 11. In particular, Knittel does not teach or suggest approximating a function by identifying an error tolerance and selecting an optimal number of set points on a curve defined by the function, as recited in claim 11. For at least this reason, claim 11 is allowable.

Claim 12

Claim 12, as amended, recites a method for approximating a gradient. The method includes receiving a gradient defining a nonlinear transition from one color or gray level to another in an image. The method further includes identifying an error tolerance. The method further includes selecting an optimal number of linear stops on a curve defined by the function. Selecting an optimal number of linear stops on a curve includes using Newton's Method to recursively sub-divide the curve to find a next linear portion that approximates a corresponding portion of the curve within the error tolerance. Selecting an optimal number of linear stops on a curve further includes locating subsequent linear stops until an end point of the curve is reached. The method further includes approximating the curve by a series of linear portions connecting the linear stops.

As explained in reference to claim 1, Knittel does not teach or suggest receiving a gradient defining a nonlinear transition from one color or gray level to another in an image. For at least this reason, claim 12 is allowable.

Further as to claim 12, while Knittel discloses a method for determining the square root of a number using predefined estimates of a square root function, Knittel is silent with regard to "predetefining", or approximating, the square root function in accordance with the method described in claim 12. In particular, Knittel does not teach or suggest approximating a function by "identifying an error tolerance, selecting an optimal number of linear stops on a curve defined by the function including using Newton's Method to recursively sub-divide the curve to find a next linear portion that approximates a corresponding portion of the curve within the error tolerance where each linear portion is defined by two linear stops, and locating subsequent linear stops until an end point of the curve is reached, and approximating the curve by a series of linear portions connecting the linear stops," as recited in claim 12. For at least this reason, claim 12 is allowable.

Claim 13

Claim 13, as amended, recites a computer program stored on a tangible medium for approximating a gradient The program includes instructions to receive a gradient defining a nonlinear transition from one color or gray level to another in an image. Claim 13 is therefore allowable for at least the reasons set forth in reference to claim 1.

Claim 14

Claim 14, as amended, recites a computer program stored on a tangible medium for approximating a gradient. The program includes instructions to receive a gradient defining a nonlinear transition from one color or gray level to another in an image. The program further includes instructions to select an optimal number of set points on a curve defined by the function. Claim 14 is therefore allowable for at least the reasons set forth in reference to claim 11.

Claim 15

Claim 15, as amended recites a computer program stored on a tangible medium for approximating a gradient. The program further includes instructions to receive a gradient defining a nonlinear transition from one color or gray level to another in an image. The program further includes instructions to identify an error tolerance. The program includes instructions to select an optimal number of linear stops on a curve defined by the function. Instructions to select an optimal number of linear stops on a curve include instructions to use Newton's Method to recursively sub-divide the curve to find a next linear portion that approximates a corresponding portion of the curve within the error tolerance. Claim 15 is therefore allowable for at least the reasons set forth in reference to claim 12.

Applicant believes that all claims are now in condition for allowance and action to that end is respectfully requested.

Please apply any charges or credits to deposit account 06-1050.

Respectfully submitted,

Date: 12/8/04

Mark D. Kirkland
Reg. No. 40,048

Fish & Richardson P.C.
500 Arguello Street, Suite 500
Redwood City, California 94063
Telephone: (650) 839-5070
Facsimile: (650) 839-5071

07844-416001_replytooa.doc